

biopsy showing "vasculitis." Treatment is difficult, and the prognosis is dismal.

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Tumescent Technique for Local Anesthesia

THE TUMESCENT TECHNIQUE for local anesthesia has made it possible to do liposuction, dermabrasion, face-lifts, carbon dioxide laser full-face resurfacing, hair transplants, and large cutaneous excisions and repairs totally by local anesthesia without intravenous sedation or narcotic analgesia. This technique is a novel approach for the delivery of local anesthesia that exploits the principle of pharmacokinetics to achieve extensive regional anesthesia of skin and subcutaneous tissue. The subcutaneous infiltration of a large volume of diluted lidocaine and epinephrine causes the targeted tissue to become swollen and firm, or tumescent, and permits a large-volume liposuction to be done entirely by local anesthesia. Depending on the clinical requirements, a tumescent anesthetic solution may contain a 5- to 20-fold dilution of the standard commercially available lidocaine (1%), epinephrine (1:100,000), and sodium bicarbonate (10 mEq per liter) in a physiologic saline solution.

A large volume of diluted epinephrine infiltrated into relatively avascular adipose tissue produces widespread prolonged and profound vasoconstriction. For a given dose, vasoconstriction diminishes the rate of systemic lidocaine absorption. This reduces both the peak plasma lidocaine concentration and the prevalence of toxicity and permits a much larger dose of lidocaine to be administered.

In fact, the tumescent technique permits safe lidocaine dosage of at least 35 mg per kg of body weight and provides effective local anesthesia for as long as ten hours. The widely accepted 7-mg-per-kg "safe maximum dose for lidocaine with epinephrine" when administered subcutaneously, as published in the *Physicians' Desk Reference* (Medical Economics, Montvale, NJ), has never been substantiated by a published scientific study.

Tumescent liposuction incorporates the tumescent technique for local anesthesia and with the use of liposuction microcannulas having an inside diameter of 2 mm and multiple small incisions for microcannular access that are not closed with sutures. Several small 2- to 3-mm incisions promote copious postoperative drainage that in turn reduces bruising, tenderness, swelling, and systemic lidocaine absorption. A description of the procedure was

first published in 1987, and tumescent liposuction entirely by local anesthesia improves the safety of large-volume liposuction substantially by virtually eliminating surgical blood loss and by completely eliminating the risks of general anesthesia, intravenous sedation, or narcotic analgesia. Traditional forms of liposuction rely on general anesthesia and are associated with so much surgical blood loss that autologous blood transfusions are often routine. Many plastic and reconstructive surgical procedures thought to require general anesthesia can now be done more safely and with less discomfort when done entirely by local anesthesia. Yet, some specialists other than dermatologists are unfamiliar with tumescent anesthesia.

Certain "tumescent paradoxes" may discourage some surgeons from using the tumescent technique and could explain why the tumescent technique has yet to gain acceptance outside of dermatologic surgery:

- Diluted lidocaine at a concentration of 0.05% to 0.1% provides better and more extensive anesthesia than more concentrated commercial preparations at 1% to 2% lidocaine.
- Diluted epinephrine at concentrations of 1:2 million to 1:1 million provides better and more extensive vasoconstriction than commercial local anesthetic solutions containing epinephrine at 1:100,000.
- Smaller 2-mm cannulas permit the removal of more fat than larger 6-mm cannulas.
- Multiple small incisions without sutures leave less apparent scars than do fewer larger incisions that are closed with sutures.
- With appropriate training and skill, tumescent liposuction is less painful and more pleasant without intravenous sedation than with intravenous sedation or general anesthesia.

New therapeutic applications of tumescent drug delivery will depend on the imagination of specialists in other clinical disciplines and the nature of the clinical problems they must solve. As an example, the tumescent delivery of chemotherapeutic agents to lymphatic vessels might be applicable to the treatment and diagnosis of disease in the lymphatic system. Because some degree of local anesthesia may persist for more than 24 hours, tumescent anesthesia may prove useful for preemptive analgesia after surgical procedures such as laparotomy or saphenectomy.

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Rhytides—New Approaches to Old Wrinkles

SOCIETY PUTS great emphasis on smooth, healthy skin as a sign of youth. It is no surprise, then, that many patients are seeking treatment of their facial rhytides (wrinkles).

Topical tretinoin (retinoic acid) has been recently approved by the Food and Drug Administration for the long-term correction of fine facial rhytides. Although its mechanism of action is unknown, tretinoin causes compaction of the stratum corneum and thickening of the epidermis and the dermis. This appears to be a safe and modestly effective alternative, even with long-term use.

Collagen and gelatin matrix implants are filling materials used in dermal augmentation. When a filling material is injected into the dermis, it provides a matrix around which new collagen forms; this effaces wrinkles. Bovine collagen (Zyderm) implant consists of sterile, purified, reconstituted fibrillar bovine collagen. After injection, there is only a short-lived (often only a few months) abatement of fine wrinkles because the body's own mechanisms degrade the collagen implant; this necessitates periodic maintenance injections. Cross-linked bovine collagen (Zyplast) is associated with less rapid biologic degradation but still requires periodic re-treatment. About 3% of patients have allergic reactions to bovine collagen skin tests and cannot receive this form of therapy.

Gelatin matrix implant (Fibrel) is activated by factors in a patient's own blood after intradermal administration. It is an absorbable gelatin powder that forms a matrix for complexing clotting factors with aminocaproic acid, a fibrinolytic inhibitor. Just before use, the material is mixed with the patient's plasma, which provides supplemental clotting factors. Ultimately the injected material is replaced by the patient's own collagen, and this elevates the soft tissue.

An experimental means of tissue augmentation is autologous fat transplantation. This consists of the suction-assisted removal of fat from one part of the body, followed by injecting that fat into an area of depression in another skin site. Unfortunately, transplanted fat has a short survival, except in areas like the forehead where there is bone underneath the skin.

The use of *Clostridium botulinum* A exotoxin to treat facial frown lines is currently being studied. Administering *C botulinum* toxin to the appropriate striated muscles produces reversible paralysis of the muscles that cause frown lines.

Chemical peeling (chemexfoliation) consists of the application of one or more organic acids to the skin, which produces epidermal and upper dermal sloughing. Many peeling agents are available, including α -hydroxy acids, trichloroacetic acid, and phenol. All result in varying degrees of destruction of the epidermis and portions of the dermis; the regeneration of epidermal and dermal tissues follows, with an effacement of fine facial rhytides. Phenol is the peeling agent that penetrates the deepest into the dermis. It is also quickly absorbed percutaneously. Systemic effects such as cardiac arrhythmias can occur, so full-face phenol peels require extensive preoperative evaluation and close postoperative monitoring. Trichloroacetic acid can produce superficial or deeper peels, depending on the concentration. The response to trichloroacetic acid is highly dependent on pre-peel skin preparation and the method of

application. α -Hydroxy acids such as glycolic acid reduce the cohesion of the keratinocytes at low concentrations; this results in mild desquamation and epidermolysis. At higher concentrations, they produce peeling into the dermis. The duration of the positive effects is under study. Complications of chemical peeling include pigmentary changes, prolonged erythema, infections, hypertrophic scarring, changes in skin texture, and atrophy.

Dermabrasion has been used for decades for effacing shallow scars and other unwanted facial defects. It involves the use of a wire brush spun at high speeds and drawn over the surface of the skin so that the entire epidermis and upper dermis are removed. Residual portions of the skin's adnexal structures proliferate and reepithelialize the smooth-planed surface. The complications of hypertrophic scarring, pigmentary changes, loss of skin texture, and enlarged facial pores are possible problems with dermabrasion.

The resurfacing carbon dioxide laser is now being extensively used to treat mild to moderate facial rhytides. As with chemical peels and dermabrasion, carbon dioxide laser surgery uses the mechanisms of epidermal and dermal regeneration and collagen and elastin remodeling. The result is a smoothing of superficial irregularities, including fine lines and wrinkles. It has been suggested that the carbon dioxide laser optimizes its clinical results by inducing collagen and elastin shrinkage through its thermal effect. The carbon dioxide laser allows for more precise depth control and is bloodless compared with dermabrasion. A new generation of carbon dioxide lasers has led to a reduction of undesirable results such as substantial thermal injury and scarring associated with conventional continuous-wave carbon dioxide lasers. Hyperpigmentation and hypertrophic scarring are possible complications of laser resurfacing.

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Diagnosis and Treatment of Cutaneous Herpes Simplex Virus Infections

HERPES SIMPLEX, caused by *Herpesvirus hominis* (herpes simplex virus, HSV) is one of the most common human infections. There are two major antigenic types: type 1, which is classically associated with orofacial infections, and type 2, which is usually genital. There may be substantial overlap, however. Both persist in sensory nerve ganglia after the primary infection. The virus may be reactivated and travel peripherally along efferent nerve fibers. It may be shed in saliva and genital secretions